# The status of infraspecific taxa and new subspecies in *Ptilotus stirlingii* (Amaranthaceae)

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## Abstract

Davis, R.W. & Butcher, R. The status of infraspecific taxa and new subspecies in *Ptilotus stirlingii* (Amaranthaceae). *Nuytsia* 20: 261–270 (2010). This paper evaluated current infraspecific taxa within *Ptilotus stirlingii* (Lindl.) F.Muell. using morphometric analysis. We conclude that var. *pumilus* Benl should no longer be recognised as a distinct variety from var. *stirlingii* and that var. *laxus* (Benth.) Benl and var. *minutus* Benl should be merged into a single taxon. The new name *P. stirlingii* subsp. *australis* R.W.Davis & R.Butcher is erected for this taxon and var. *stirlingii* is elevated in rank. With these changes, *P. stirlingii* now comprises two subspecies rather than four varieties. Revised descriptions and a key are presented for the new subspecies.

## Introduction

This paper is one of a continuing series dealing with appropriate ranks for Western Australian infraspecific taxa within *Ptilotus* R.Br., in preparation for the *Flora of Australia* treatment of Amaranthaceae. It discusses the differences between the existing varieties of *P. stirlingii* (Lindl.) F.Muell., and establishes a new name, *P. stirlingii* subsp. *australis* R.W.Davis & R.Butcher, *subsp. nov.*

Benl (1959, 1967) recognised four varieties in *Ptilotus stirlingii*: var. *stirlingii* (Lindl.) F.Muell., var. *pumilus* Benl, var. *laxus* (Benth.) Benl and var. *minutus* Benl. The varieties are distributed in two pairs within the South-west Botanical Province: var. *stirlingii* and var. *pumilus* occur in the north of this region in the area between Perth, Shark Bay and Manmanning, which is in the Avon Wheatbelt IBRA region (*Interim Biogeographic Regionalisation for Australia*; Department of Environment, Heritage, Water and the Arts 2008); var. *laxus* and var. *minutus* are distributed in the south, from the south-eastern edge of the Stirling Range eastward across the Esperance Plains IBRA region. *Ptilotus stirlingii* var. *pumilus* is currently listed as a Priority One taxon under the Western Australian Department of Environment and Conservation's (DEC) Conservation Codes for Western Australian Flora (Smith 2010). One of its two disjunct populations occurs within the distribution range of var. *stirlingii*. Across their distributions, the few populations of var. *laxus* and var. *minutus* are closely allopatric, with var. *laxus* occurring closer to the coast than var. *minutus* (Western Australian Herbarium 1998–).

The key morphological character used by Benl (1967) for separating the northern pair of varieties from the southern pair was stem and leaf indumentum. The northern pair (vars *stirlingii* and *pumilus*) are recorded as cobwebby-pubescent or woolly-tomentose, while the southern pair (vars *laxus* and *minutus*) are recorded as glabrous or glabrescent.

Benl (1967) cited two differences between var. *stirlingii* and var. *pumilus*, with the latter (described from only the holotype) having a woolly indumentum on stems and leaves and tepals 8–9 mm long and the former having a sparser indumentum and tepals to 10–12 mm long. As additional specimens have been lodged at the Western Australian Herbarium (PERTH) it has become clear that these differences are not consistent. Indumentum grades subtly from sparsely hairy to woolly among all northern specimens and tepal length has now been found to vary continuously from (7.2–)8–14 mm. These differences appear to be influenced by environmental factors, with plants in drier habitats tending to have smaller tepals and woollier indumentum.

Benl (1967) regarded var. *minutus* and var. *laxus* as differing from each other in leaf shape and flower number, with var. *minutus* having narrowly elliptic leaves and 8–12 flowers per spike and var. *laxus* having broadly cuneate to obovate leaves and 15–20 flowers per spike. Again, these characters have now been found to vary continuously among southern specimens of *P. stirlingii*, and gradation in leaf shape from elliptic to obovate is observable on some individual specimens (e.g. PERTH 07256361). Interestingly, the holotype of var. *minutus* (in early flower) clearly has more than 12 flowers per spike.

In summary, revisionary study of *Ptilotus stirlingii* has determined that the characters used to distinguish the pairs of varieties are continuous in nature. As such, recently collected specimens are difficult to place under the existing taxonomy. A morphometric analysis of *P. stirlingii* was therefore undertaken to test the robustness of Benl's taxonomy.

## Methods

Ten characters (six continuous quantitative characters, two quantitative ratio characters and two qualitative binary/multistate characters; Table 1) were measured for 50 specimens of *Ptilotus stirlingii* held at PERTH. These comprised two specimens of var. *laxus* (of three held at PERTH), two specimens of var. *pumilus* (of two), four specimens of var. *minutus* (of four; one originally identified as *P.* aff. *stirlingii*) and 35 specimens of var. *stirlingii* (of 55; one originally identified as *P.* aff. *stirlingii*, six originally identified as var. indet.). Type material of var. *minutus* is held at PERTH but was not included in the analysis as the spikes are immature. All characters were measured from herbarium specimens. Voucher specimen details are presented in Table 2.

Five measurements were made per character with the mean used in morphometric analysis. Characters were selected to include those used by Benl to separate the varieties of *P. stirlingii* (i.e. tepal length, leaf shape and indumentum of stems and leaves) and to include others found by the first author to be generally reliable for discriminating taxa within the genus (i.e. style, bract and bracteole length). Number of flowers per inflorescence (used by Benl to separate var. *laxus* and var. *minutus*) was not used as it was difficult to count accurately and is highly variable on individual specimens due to the indeterminate growth of the spike axis (the majority of PERTH specimens lacked fully mature spikes). *Ptilotus stirlingii* differs in this regard from few-flowered species such as *P. beardii* Benl and *P. rigidus* Lally. Spike length (and therefore flower number) in *P. stirlingii* has also been observed to be affected by growing conditions. Indumentum was assessed using a dissecting microscope and subjectively coded to reflect the variation observed. Habit was coded from specimen label data and/or by interpretation of the specimen itself.

**Table 1.** Characters used in the morphometric analysis of *Ptilotus stirlingii* and character codes used in the NMDS ordination.

| **Quantitative characters** | **Code** |
|---|---|
| 1. Bract length (mm): | BL |
| 2. Bracteole length (mm): | BrL |
| 3. Tepal length (mm): | TL |
| 4. Style length (mm): | SL |
| 5. Leaf length (mm): | LL |
| 6. Leaf width (mm): | LW |
| 7. Leaf length:width (ratio): | LL/LW |
| 8. Widest point of the leaf relative to total length (ratio): | DW/LL |
| **Qualitative characters** | |
| 1. Indumentum of stems and leaves: 0 – very sparse, 1 – sparse, 2 – moderate, 3 – woolly, 4 – densely woolly | IND |
| 2. Habit: 0 – prostrate, 1 – sprawling to decumbent | HAB |

The resulting data matrix was analysed phenetically using the software package Primer 6 (v. 6.1.13) (Clarke & Gorley 2006). The Gower metric (Gower 1971) was used to create a resemblance matrix, as it is suitable for use with datasets containing a mixture of qualitative and quantitative characters (Crisp & Weston 1993; Flann *et al.* 2008). The unweighted pair-group method of arithmetic averages (UPGMA) was used to create a dendrogram of hierarchically clustered individuals from this association matrix. This matrix was also used to derive an ordination using non-metric multidimensional scaling (NMDS). The ordination was run 100 times using random starting configurations and the result having the lowest Kruskal stress value in two- and three-dimensional space retrieved. Spearman rank correlation coefficients were calculated to assess the relative contribution of each character to the ordination.

## Results

Cluster analysis of the *Ptilotus stirlingii* dataset identified two main groups: the first consisted of the two samples of var. *laxus* and the four samples of var. *minutus* united at a similarity level of *c.* 81, while the second contained the two samples of var. *pumilus* and all the samples of var. *stirlingii* united at a similarity level of *c.* 67. The two groups were united at a similarity level of *c.* 59 (Figure 1). The same associations between the varieties were recovered in the two- and three-dimensional NMDS ordinations (Figure 1; three-dimensional ordination not shown), where there is a clear separation between the samples of vars *pumilus+stirlingii* from vars *laxus+minutus*. Kruskal stress values for the ordinations were 0.17 for the two-dimensional space and 0.11 for the three-dimensional space, indicating that a reasonably high degree of distortion of the data was required for it to fit the low number of dimensions (Quinn & Keough 2002). These stress values are still sufficiently low for the configurations between the samples to be considered a good representation of the similarity matrix (Quinn & Keough 2002). Characters contributing most to the separation between vars *laxus+minutus* from vars *pumilus+stirlingii* (Figure 1; Table 3) are bracteole length (Spearman's R = -0.5856), leaf shape, as represented by the position of the widest point relative to the length (R = -0.5815), habit (R = 0.5582), bract length (-0.4596) and the leaf length:width ratio (R = 0.4296), while those contributing most to the spread of samples within each group are indumentum (R = -0.8165), leaf width (R = -0.7569) and leaf length (R = -0.5968).

**Table 2.** Voucher specimens used in the morphometric analysis of *Ptilotus stirlingii sens. lat.* indicating the variety each specimen was identified as at the time of analysis and the subspecies to which it is now assigned. PERTH sheet numbers were used to label the specimens in the analysis. Specimens marked with an asterisk (*) had been previously identified as *P.* aff. *stirlingii*; specimens marked with a caret (^) had previously been identified as *P. stirlingii* var. indet.

| Variety | Subspecies | Collector | Locality | Voucher |
|---|---|---|---|---|
| *laxus* | *australis* | *J. Bowen* 15 | Coomalbidgup via Esperance, Lort River | PERTH 00842680 |
| *laxus* | *australis* | *K.R. Newbey* 1608 | Culham Inlet | PERTH 00226874 |
| *minutus** | *australis* | *R. Davis* 10956 | 6.3 km N along track from Melaleuca Rd, *c.* 43 km NNW at Munglinup | PERTH 07256361 |
| *minutus* | *australis* | *N.N. Donner* 3052 | Location 1110, c. 30 km NNE of Young River Crossing on Ravensthorpe–Esperance road | PERTH 00226386 |
| *minutus* | *australis* | *Hj. Eichler* 20277 | S portion of Location 1117, c. 45 km N of Stokes Inlet (Stokes Inlet is c. 75 km W of Esperance) | PERTH 00335665 |
| *minutus* | *australis* | *P.G. Wilson* 8042 | Block 1156, Oldfield location, 13 km W of Young River | PERTH 230502, CANB |
| *pumilus* | *stirlingii* | *R.J. Cranfield* 2557 | 36.89 km W from Denham turnoff, Tamala Station | PERTH 220248 |
| *pumilus* | *stirlingii* | *B.H. Smith* 1026 | Avon Loc. 18304, 2 miles SW of Manmanning | PERTH 02664208 |
| *stirlingii* | *stirlingii* | *C. Andrews* 1: 715 | Blackwall Reach | PERTH 00226815 |
| *stirlingii* | *stirlingii* | *D.R. Bellairs* 1093 | 10 km E of Kalbarri | PERTH 00232033 |
| *stirlingii* | *stirlingii* | *G. Benl* 71 *& K.F. Kenneally* 7530 | Yanchep National Park, behind the emu enclosure | PERTH 00225916 |
| *stirlingii* | *stirlingii* | *E.M. Bennett* 182 | Yanchep, 33 miles N of Perth | PERTH 00226300 |
| *stirlingii* | *stirlingii* | *A. Bowden* 11 | 3 km S of Seabird | PERTH 04594819 |
| *stirlingii* | *stirlingii* | *N.T. Burbidge* 8043 | Moore River Road, N of Yanchep National Park | PERTH 00226394 |
| *stirlingii* | *stirlingii* | *A.C. Burns* 111 | East Yuna, NE of Geraldton | PERTH 00226351, MEL |
| *stirlingii* | *stirlingii* | *A.C. Burns* 139 | Between Walkaway and Burma Rd, SE of Geraldton | PERTH 00222747, CANB |
| *stirlingii* | *stirlingii* | *Y. Chadwick* 1783 | 172.5 miles [276 km] from Mount Magnet, Geraldton road | PERTH 00231525 |
| *stirlingii*^ | *stirlingii* | *R. Davis* 417 | 10 km SW of Regans Ford | PERTH 04590856 |
| *stirlingii* | *stirlingii* | *Dr Diels & Pritzel* 567 | Swan district | PERTH 00226785 |
| *stirlingii*^ | *stirlingii* | *J. Docherty* 101 | Railway Track, 1.4 km E of Peter Rd | PERTH 06058825 |
| *stirlingii*^ | *stirlingii* | *J. Docherty* 198 | Railway reserve 3.4 km E of Peter Rd on Mullewa/Geraldton Rd | PERTH 06877729 |
| *stirlingii* | *stirlingii* | *J. Firth* 17 | Waggrakine | PERTH 05396468 |
| *stirlingii* | *stirlingii* | *C.A. Gardner* 662 | Mogumber | PERTH 00231967 |
| *stirlingii* | *stirlingii* | *C.A. Gardner* 1162 | Mogumber | PERTH 00231975 |

| | | | | |
|---|---|---|---|---|
| *stirlingii* | *stirlingii* | *A.S. George* 9753 | Near Warradong Spring, SW of Mingenew | PERTH 231959 |
| *stirlingii* | *stirlingii* | *E.A. Griffin* 2516 | Hill S of Cockleshell Gully, NE of Jurien | PERTH 231932 |
| *stirlingii* | *stirlingii* | *E.A. Griffin* 6651 | Near coast, Wanagarren Nature Reserve (# 31675), E of Wedge Is. | PERTH 3155412 |
| *stirlingii* | *stirlingii* | *J. Havel* 207 | Caraban Rd, NW of Yanchep | PERTH 00226769 |
| *stirlingii* | *stirlingii* | *R. Helms s.n.* | North Fremantle | PERTH 00226807 |
| *stirlingii* | *stirlingii* | *R. Hnatiuk* 761377 | 26 km SE of Coomallo Ck on Brand Hwy | PERTH 232424 |
| *stirlingii* | *stirlingii* | *A.M. James* 163 | Yanchep National Park: E side of main road, 2 miles N of park entrance turnoff | PERTH 00226831 |
| *stirlingii*^ | *stirlingii* | *G.J. Keighery & N. Gibson* 6032 | 200 m N of Burma Rd, Burma Road Nature Reserve, c. 45 km NW Mingenew | PERTH 06680267 |
| *stirlingii* | *stirlingii* | *K.F. Kenneally* 2421 | Proposed flora reserve, 11 km E York, then 5 km along Tammin Rd | PERTH 231924 |
| *stirlingii* | *stirlingii* | *K.J. Knight* 364 | Wongan Hills Experimental Farm, Reserve 18672, Craig Rd, c. 6.5 km by road N of Wongan Hills | PERTH 823503 |
| *stirlingii* | *stirlingii* | *F. Lullfitz* L 1922 | Badgingarra West | PERTH 00226378 |
| *stirlingii* | *stirlingii* | *K. Macey* 796 | Poison Paddock; New Norcia | PERTH 07192959 |
| *stirlingii* | *stirlingii* | *A. Morrison s.n.* | Watheroo | PERTH 00231940 |
| *stirlingii* | *stirlingii* | *A.E. Orchard* 4200 | Just outside E boundary of Kalbarri National Park, on road to Ajana | PERTH 231541 |
| *stirlingii*^ | *stirlingii* | *M. Puckridge* 23 | Behind the CWC Senior Citizens Centre, Bashford St., Jurien Bay | PERTH 05455677 |
| *stirlingii** | *stirlingii* | *W. Rogerson* 347 | Yuna, NE of Geraldton | PERTH 00239585 |
| *stirlingii* | *stirlingii* | *R.D. Royce* 1121 | E of Geraldton | PERTH 00305502 |
| *stirlingii* | *stirlingii* | *R.D. Royce* 8015 | Eradu, 0.5 mile from Greenough River | PERTH 00226823, CANB |
| *stirlingii* | *stirlingii* | *B.H. Smith* 315 | Railway near Manmanning (south) at No. 3301 telephone pole | PERTH 232416, AD, BRI, CBG, HO, NSW |
| *stirlingii* | *stirlingii* | *A. Strid* 21687 | Hill River | PERTH 232009 |
| *stirlingii* | *stirlingii* | *A. Strid* 21721 | By the small town of Piawaning, NE of New Norcia | PERTH 232408 |
| *stirlingii* | *stirlingii* | *V. Westcott* L.D. 58 A | Beekeepers Nature Reserve (NR 24496), 17.1 km W of Brand Hwy along Eneabba–Coolimba road | PERTH 08146713 |
| *stirlingii* | *stirlingii* | *D.J.E. Whibley* 4948 | 15 km W of Coomberdale, near border of Avon District and South Irwin | PERTH 226297 |
| *stirlingii* | *stirlingii* | *R.T. Wills* RTW 1 | Site 94, Beekeepers Reserve | PERTH 06384005 |
| *stirlingii* | *stirlingii* | *R.T. Wills s.n.* | Site 50, Beekeepers Reserve Collection | PERTH 06400752 |
| *stirlingii*^ | *stirlingii* | *D. Woodman* GW OP 13 | Vacant Crown Land N of State Forest 65 North | PERTH 06129889 |

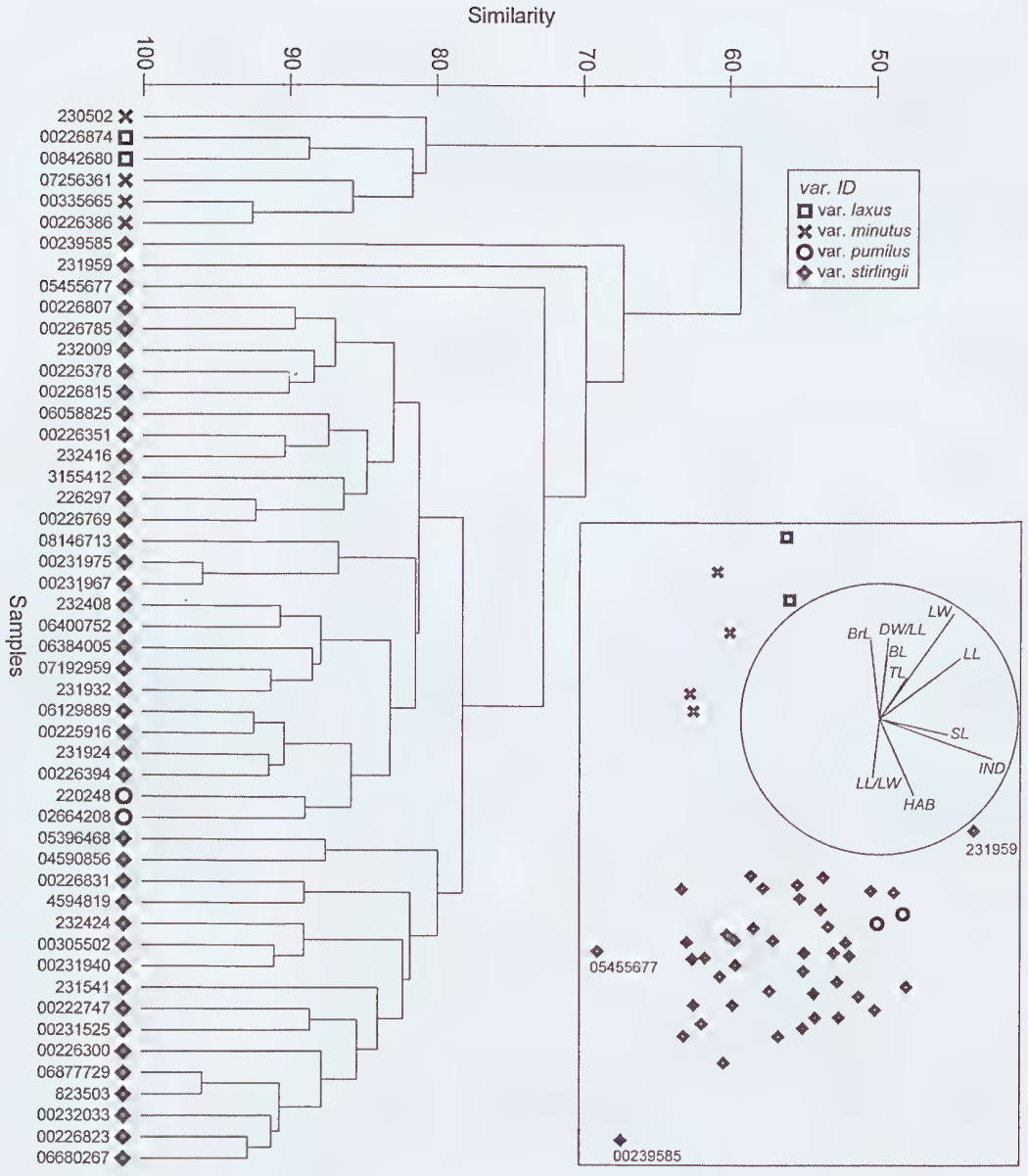


**Figure 1.** UPGMA dendrogram and (inset) 2-dimensional NMDS ordination of the four varieties of *Ptilotus stirlingii* based on 50 specimens by 10 characters, using the Gower metric. The direction of contribution of each character to the ordination, calculated by the Spearman rank correlation coefficient, is illustrated in the circular inset. Samples labelled by their PERTH sheet numbers. Character codes as for Table 1.

Three specimens of var. *stirlingii* (PERTH 231959, PERTH 00239585, PERTH 05455677) are peripheral to the remaining samples in both the cluster analysis and NMDS (Figure 1). Of these, PERTH 00239585 had previously been identified as *P.* aff. *stirlingii* and is notable for having small leaves and flowers, while PERTH 05455677 had not been identified to variety originally and is notable for having small flowers. The third specimen, PERTH 231959, differs from the remaining var. *stirlingii* specimens in having longer and broader leaves.

**Table 3**. Spearman rank correlation coefficients between the characters used to create the NMDS ordination and the ordination axes. Character codes as for Table 1.

| | BL | BrL | TL | SL | LL | LW | LL/LW | DW/LL | IND | HAB |
|---|---|---|---|---|---|---|---|---|---|---|
| **MDS 1** | -0.4596 | -0.5856 | -0.3078 | 0.1061 | -0.4351 | -0.7598 | 0.4296 | -0.5815 | 0.3105 | 0.5582 |
| **MDS 2** | -0.0617 | 0.0751 | -0.1698 | -0.4614 | -0.5968 | -0.5606 | 0.0682 | -0.0761 | -0.8165 | -0.2315 |

## Discussion

The morphometric analysis suggests that only two subspecific taxa should be recognised in *Ptilotus stirlingii*, rather than the four varieties recognised by Benl (1959, 1967). Of the characters used by Benl to differentiate between the pairs of varieties, tepal length (for vars *pumilus* cf. *stirlingii*) and leaf shape (for vars *laxus* cf. *minutus*) intergrade, have low Spearman Rank coefficients on MDS2 (Table 3) and do not clearly separate their respective taxa. Indumentum is more highly correlated with the ordination (R = -0.8165 on MDS2); however, some specimens of var. *stirlingii* are as woolly as specimens of var. *pumilus*, and there is a complete intergrade of indumentum density from nearly glabrous to densely woolly among the northern specimens.

Accordingly, we recognise here two taxa, a northern taxon combining var. *stirlingii* and var. *pumilus*, and a southern taxon, combining var. *minutus* and var. *laxus*, based on the two clear groups recovered by the classification and ordination. These two taxa are best recognised as subspecies of a broadly circumscribed *P. stirlingii*. They are widely allopatric and differ most obviously in habit, with the southern plants being prostrate while the northern ones are arching to sprawling, and bract and bracteole length, with the northern taxon having bracts 1.8–4.5 mm long and bracteoles 3–5 mm long and the southern taxon having bracts 5.3–7.5 mm long and bracteoles 5.4–6.3 mm long. Leaf shape is a useful supplementary character, with the southern taxon having oblanceolate to obovate leaves, in addition to elliptical leaves, while the northern taxon has elliptical leaves. For clarity, the new name *Ptilotus stirlingii* subsp. *australis* R.W.Davis & R.Butcher *subsp. nov.* is erected here for the southern taxon, in preference to retaining either of Benl's varietal names. The northern taxon retains the autonym at subspecific rank.

## Taxonomy

**Ptilotus stirlingii** (Lindl.) F.Muell., *Syst. Census Austral. Pl.* 1:28 (1882). *Trichinium stirlingii* Lindl., *Edwards's Bot. Reg.* 25: 28 (1839). *Type*: Swan River Colony, [Western Australia], *J. Stirling s.n.* (*holo*: CGE *n.v.*).

*Trichinium carneum* Moq. in A.P. de Candolle, *Prodr.* 13(2): 291 (1849). *Type*: Lower Swan R., [Western Australia], *C. Fraser* 158 (*holo*: P? *n.v.*; *iso*: K image!).

Arching, decumbent, sprawling or prostrate *perennial herb* to 30 cm high. *Stems* terete, ribbed, sparsely hairy to woolly, sometimes glabrescent. *Cauline leaves* alternate, petiolate, narrowly elliptical or oblanceolate to obovate, 5–50 mm long, 1–8 mm wide, glabrous or sparsely hairy to woolly, margins undulate. *Inflorescences* solitary, terminal, pink to pale pink, spherical or ovoid to shortly cylindrical, 10–37 mm long, 15–28 mm wide; *bracts* translucent, tinged pink towards centre, narrowly ovate to ovate, 1.8–7.5 mm long, sparsely hairy with verticillate to nodose hairs, becoming glabrous towards the margins; *bracteoles* translucent, tinged pink along midrib, ovate to broadly ovate or obovate to broadly obovate, 3–6.3 mm long, glabrous or sometimes with sparse, verticillate hairs along midrib. *Flowers* pedicellate; *outer tepals* pink to pale pink, tinged white, narrowly oblanceolate, concave, (7.2–)8–14 mm long, hairy except at apex, with verticillate hairs, apex rounded to truncate, sometimes retuse or apiculate, serrated; *inner tepals* (6.8–)7.5–13.5 mm long, with a basal tuft of hairs on inner face; *staminal cup* 1.7–3 mm long, glabrous; *stamens* 2; *staminodes* 3; *style* slightly curved, sub-centrally fixed to ovary, 2.9–5.1 mm long; *ovary* glabrous. *Seed* slightly glossy to glossy, brown, to 1.8 mm long.

*Notes. Ptilotus stirlingii* is often misidentified as *P. sericostachyus* and is relatively close morphologically. The following key can be used to separate *P. sericostachyus* and the infraspecific taxa of *P. stirlingii*.

**Key to taxa**

1. Staminal cup hairy, style markedly falcate ..... **P. sericostachyus**
1. Staminal cup glabrous, style slightly curved ..... **P. stirlingii**
2. Plants arching or sprawling, bracts 1.8–4.5 mm long, bracteoles 3–5 mm long ..... **P. stirlingii** subsp. **stirlingii**
2. Plants prostrate, bracts 5.3–7.5 mm long, bracteoles 5.4–6.3 mm long ..... **P. stirlingii** subsp. **australis**

**Ptilotus stirlingii** subsp. **stirlingii**

*Ptilotus stirlingii* (Lindl.) F.Muell. var. *pumilus* Benl, *Muelleria* 1: 108 (1959). *Type*: Shark Bay, Western Australia, October 1877, *F. Mueller s.n.* (*holo*: MEL!).

Arching, decumbent or sprawling *perennial herb* to 30 cm high. *Stems* terete, ribbed, sparsely hairy to woolly. *Cauline leaves* narrowly elliptical to oblanceolate, 5–50 mm long, 1–8 mm wide, sparsely hairy to woolly. *Inflorescences* spherical to ovoid, 10–35 mm long, 15–27 mm wide; *bracts* narrowly ovate to ovate, 1.8–4.5 mm long; *bracteoles* ovate to broadly obovate, 3–5 mm long. *Outer tepals* (7.2–)8–12 mm long; *inner tepals* (6.8–)7.5–11.5 mm long; *staminal cup* 1.7–2.5 mm long; *style* 2.9–5 mm long; *ovary* glabrous. *Seed* glossy, brown, to 1.7 mm long.

*Distribution and habitat.* Distributed from Shark Bay southward to Perth, in the Swan Coastal Plain and Geraldton Sandplains IBRA regions, and eastward into the west and north-western edges of the Avon Wheatbelt IBRA region. Found in a wide range of habitats. Common on sandy, coastal heaths through to kwongan sandplains and woodlands.

*Phenology.* Flowering from late October through to January.

*Notes*. The Priority One conservation listing for *Ptilotus stirlingii* var. *pumilus* (Smith 2010) is no longer necessary as this variety has been subsumed within subsp. *stirlingii*, which is not considered to be under threat.

**Ptilotus stirlingii** subsp. **australis** R.W.Davis & R.Butcher, *subsp. nov.*

*Typus*: 6.3 km north along track from Melaleuca Road, *c.* 43 km north-north-west of Munglinup, Western Australia, 33° 20' 55.3" S, 120° 39' 10.3" E, 12 December 2005, *R. Davis* 10956 (*holo*: PERTH 07256361; *iso*: CANB, K).

*Ptilotus stirlingii* (Lindl.) F.Muell. var. *minutus* Benl, *Mitt. Bot. Staatssamml. München* 6: 503 (1967). *Type*: Grass Patch, Western Australia, October 1931, *W.E. Blackall* 1028 (*holo*: PERTH!; *iso*: PERTH!).

*Ptilotus stirlingii* (Lindl.) F.Muell. var. *laxus* (Benth.) Benl, *Mitt. Bot. Staatssamml. München* 6: 500 (1967). *Trichinium laxum* Benth., *Fl. Austral.* 5: 232 (1870); *Ptilotus laxus* (Benth.) F.Muell., *Syst. Census Austral. Pl.* 1: 28 (1882). *Type*: between Cape Le Grand and Cape Pasley, [Western Australia], *G. Maxwell s.n.* (*holo*: MEL *n.v.*; *iso*: BM *n.v.*, K (image!); MEL *n.v.*).

Prostrate *perennial herb* to 8 cm high. *Stems* terete, ribbed, sparsely hairy. *Cauline leaves* narrowly elliptical or oblanceolate to obovate, 5–30 mm long, 2–7 mm wide, glabrous to sparsely hairy. *Inflorescences* ovoid to shortly cylindrical, 20–37 mm long, 22–28 mm wide; *bracts* narrowly ovate, 5.3–7.5 mm long; *bracteoles* broadly ovate to obovate, 5.4–6.3 mm long. *Outer tepals* 10–14 mm long; *inner tepals* 10.5–13.5 mm long; *staminal cup* 2.5–3 mm long; *style* 3.5–5.1 mm long; *ovary* glabrous. *Seed* slightly glossy, brown, to 1.8 mm long.

*Distribution and habitat*. Distributed through a large part of the Esperance Plains IBRA region, where it is mostly found in coastal areas, although extends as far inland as the Stirling Range and Grasspatch. Occurs in heathlands and mallee woodlands on deep sands to gravelly loams.

*Phenology*. Flowering from late October though to January.

*Notes*. *Ptilotus stirlingii* subsp. *australis* is poorly collected but from the material available it appears to be reasonably consistent morphologically. Field observations suggest that it may only be abundant after fire, perhaps accounting for the relatively few collections.

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